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# Sustainable Development of Aquaculture in Turkey and Its Constraints

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**Abstract:** Aquaculture means the farming of aquatic animals and plants. Turkey has rich inland water sources, about 200 natural lakes, about 750 artificial lakes or ponds, about 193 reservoirs, 33 rivers and streams of 177.714 km length and 8.333 km of coastal strips. Aquaculture sector in Turkey is new when compared with European countries. The first fish farm was established as a rainbow trout farm in 1970s. The following years, new fish farms have been established year by year. The main fish species cultured in Turkey are Carp (*Cyprinus carpio*), Rainbow trout (*Oncorhynchus mykiss*), Atlantic salmon (*Salmo salar*), Gilthead sea bream (*Sparus aurata*), European sea bass (*Dicentrarchus labrax*), Bluefin tuna (*Thunnus thynnus*), Black sea turbot (*Psetta maxima*), Mediterranean mussel (*Mytilus galloprovincialis*) and Shrimp (*Penaeidae* spp). Aquaculture production of Turkey has grown steadily over the years from 5782 tonnes in 1990 to 63 000 tonnes in 1999 and to 136 000 tonnes in 2007.

**Keywords:** Sustainable Development, Aquaculture, Fish Farming, Turkey

## Introduction

The historic of aquaculture is very old. The first records of aquaculture activities in 2500 BC can be found in the tomb of Akthep during the ancient Egyptian civilisation. In the Etruscan Culture in Italy the earliest marine farms date back to 6th century BC. The China is the first country in Asia where aquaculture has been started during the dynasty of When Fang (1135-1122 BC). Fan Li wrote Classic of Fish Farming at the years of 460 BC in China (Canyurt 2005).

Marine and inland water resources provide an important source of protein for human nutrition. Because of this reason fish farming in the world is a growing industry in recent years. According to the FAO statistics the world aquaculture production by inland and marine waters grows from 24.456.561 tonnes in 1993 to 51.385.912 tonnes in 2002. The total world fisheries production (capture and aquaculture) is 143.647.650 tonnes and aquatic plant production is 15.075.612 tonnes in 2006.

The aquaculture sector in Turkey is facing some constraints, such as: the complexity of licensing procedures, site selection problems, the complexity of project preparation and application, problems with some other sectors, like tourism, protected areas and navigations, high prices of inputs and difficulties in supplying, disease risk with imported eggs and fry, marketing and quality control problems, organization and governance (Canyurt et al. 2003; Canyurt 2005).

## Development of Aquaculture in Turkey

Numerous rivers drain Turkey's plateaus and mountains. The rivers are usually swift flowing and relatively short. A number of rivers do not flow during the dry summer. Some rivers are, however, important

sources of hydroelectric power and water for irrigation.

The Kızılırmak (1,150 km/715 mi long), is the longest river flowing entirely within Turkey. The Sakarya River and the Kızılırmak flow into the Black Sea. Gediz and Büyükenderes (ancient Meanderes) in Aegean region, the Ceyhan and Seyhan rivers in south flow from the Taurus Mountains to the Mediterranean. The Tigris and Euphrates rivers, which flow southeast through Syria and Iraq to the Persian Gulf are important rivers in Turkey.

Production fields	Number	Surface Area (Ha)	Length (Km)
Natural Lakes	200	906.118	–
Dam Lakes	193	342.377	–
Ponds (Artificial Lakes)	750	15.500	–
Rivers and streams	33	–	177.714
Seas (Coastal Strips)	–	24.607.200	8.333
TOTAL		25.871.195	

Table 1: Water Capacity of Turkey for Aquaculture (TUIK 2007)

Years	Product. (Ton)	Export (Tons)	Import (Tons)	Domestic consump. (Tons)	Processed (fish meal and oil factories) (Tons)	Not processed or consumed (Tons)	Consump. per capita (kg/year)
1997	500 260	18 402	39 829	490 339	21 000	10 348	7.663
1998	513 900	11 558	31 417	528 935	30 000	4.824	8.119
1999	636 824	15 955	39 552	503 249	150 000	7.172	7.590
2000	582 376	14 533	44 230	538 764	71 000	2.309	7.985
2001	594 977	18 978	12 971	517 832	62 755	8.383	7.547
2002	627 847	26 860	22 532	466 289	156 000	1.230	6.697
2003	587 715	29 937	45 606	470 131	120 000	13.253	6.649
2004	644 492	32 804	57 694	555 859	105 000	8.523	7.812
2005	544 773	37 655	47 676	520 985	30 000	3.809	7.229
2006	661 991	41 973	53 563	597 738	60 000	15.843	8.191
2007	772 323	47 214	58 022	604 695	170 000	8.436	8.567

Table 2: Production, export, import and consumption of fishery products (TUIK 2007)

The largest lake in Turkey is Van Gölü (Lake Van), located in eastern Anatolia. The water of Van Gölü is saline and contains soda. A member of the Cyprinidae family, the *Chalcalburnus tarichi* is a fish species that only inhabits the Lake Van Basin. The Lake Van is the biggest soda lake in the world, Lake Tuz is located near the center of the Anatolian Plateau. Freshwater lakes include Beyşehir, Eğirdir and Burdur in the southwest (Arabacı & San 2004).

Turkey has rich inland water sources, about 200 natural lakes, about 750 artificial lakes or ponds, about 193 reservoirs, 33 rivers and streams of 177.714 km length and 8.333 km of coastal strips (Tab. 1). Some lagoons covering of 70.000 hectares in Aegean and Mediterranean coastal strips are very suitable for aquaculture. Another aquaculture potential will be obtained with the South East Anatolia Project (GAP) in the lower Euphrates River and Tigris River basins. This project is the largest regional development project in Turkey, and one of the largest in the world, integrating development of irrigated agriculture and agro-industry, supporting services, including communications, health and education (Canyurt 2006).

The project area covers 74.000 km<sup>2</sup> that correspond to 9.2 % of the total surface area of Turkey. About 224.000 ha of water surface will be obtained at the end of this project; this will be a big aquaculture production potential for the country.

## Situation of Aquaculture in Turkey

Aquaculture production, exportation, importation and consumption:

According to TUIK data (2007), Turkey produces 772.323 tonnes, exports 47.214 tonnes and imports 58.022 tonnes of fish and fisheries products. The amount of non-food usage is 170.000 tonnes that is used for feed and oil industry. The population of the country is 68.279.000 tonnes and consumption per capita is 8.6 kg/year (TUIK 2007).

All activities in fisheries and aquaculture in Turkey are based on the Water Products Law No. 1380, enacted in 1971 (Canyurt 1996, Canyurt and Gökoğlu 1997). The Ministry of Agriculture and Rural Affairs is responsible for all kind of aquaculture activities and fisheries in the country (Deniz 2007). The Ministry undertakes its duties in aquaculture and fisheries management through four General Directorates and as well as 81 Provincial Directorates. During 1980's significant effort was devoted to preparing laws which are related to the management of coastal and inland water sources.

Aquaculture has been included in the encouragement decree published by governments and the Agriculture Bank of Turkey applied interest rates to support and to encourage investments in aquaculture. In addition to encouragement measures and financial support of the Governments, the Universities attach great importance to the research activities and education of engineers and technicians in 17 Faculties of Fish Products and 6 Professional Colleges and Fisheries Department expanded all of the country..

The main fish species cultured in Turkey are Carp (*Cyprinus carpio*), Rainbow trout (*Oncorhynchus mykiss*), Atlantic salmon (*Salmo salar*), Gilthead sea bream (*Sparus aurata*), European sea bass (*Dicentrarchus labrax*), Bluefin tuna (*Thunnus thynnus*), Black sea turbot (*Psetta maxima*), Mediterranean mussel (*Mytilus galloprovincialis*) and Shrimp (*Penaeidae* spp) (Tab. 3) (Canyurt, 2005). Aquaculture production of Turkey has grown steadily over the years from 5.782 tonnes in 1990 to 63.000 tonnes in 1999 and to 139.873 tonnes in 2007 (Tab. 3). The aquaculture production in inland water is 59 033 tonnes, but it reaches 80 840 tonnes in marine waters in 2007.

Aquaculture production (Tons)	2003	2004	2005	2006	2007
Inland water					
Trout	39 674	43 432	48 033	56 026	58 433
Carp	543	683	571	668	600
Marine water					

Trout	1 194	1 650	1 249	1 633	2 740
Sea bream	16 735	20 435	27 634	28 463	33 500
Sea bass	20 982	26 297	37 290	38 408	41 900
Mussel	815	1 513	1 500	1 545	1 100
Other	–	–	2 000	2 200	1 600

Table 3: Aquaculture Production in Turkey (2003–2007), (TUIK 2007)

The numbers of aquatic farms are shown in Table 4. There are 1.261 farms in inland water producing approximately 55 425 tonnes of fresh water fish species and 120 farms producing 160 000 000 fish eggs, 324 farms at sea producing 91.815 tonnes of sea fish species, mainly Gilthead sea bream and European sea bass and 348 000 000 fish eggs (Deniz 2007).

Fish Species	Number of Farms	Capacity (t/year)
Trout	1 112	53 020
Common carp	29	2 405
Trout Hatchery	120	160 000 000 eggs
Sea bass and Sea bream	286	80 509
Trout in sea cages	6	2 250
Trout and sea bass	6	1 160
BluefinTuna	6	6 300
Sea bass, sea bream and other species hatchery	17	348 000 000
Mediterranean mussel	3	1 596
TOTAL		

Table 4: Number of Licensed Aquaculture Farms and Capacities (Deniz 2007)

## Constraints of Sustainable Aquaculture in Turkey

The Ministry of Agriculture and Rural Affairs (MARA) is the main organization responsible for fisheries including aquaculture administration, regulation, protection, promotion and technical assistance. The Directorate General for Agriculture Production and Development of MARA is the responsible authority for development and management of aquaculture (Deniz 2007). There are also a number of other ministries and institutions with a role in fisheries and aquaculture development in Turkey. The Undersecretariat of Treasury and Foreign Trade of the Prime Ministry, which regulates fish import and export, State Planning Organization which formulate policy and determines the development targets for the fisheries and aquaculture sector, and the Agriculture Bank through which fisheries and aquaculture credits are channelled (Canyurt & Gökoğlu 1997 and FAO 2008).

According to Fisheries Law numbered 1380 the procedures and principles related to aquaculture are determined by the Aquaculture Regulation. This regulation sets out the methods for site selection for farms, application of the projects, giving technical supports and surveying environmental impacts (Deniz2007).

Especially marine aquaculture systems are criticised for their environmental and ecological impacts. The extensive and semi intensive farming methods have less environmental impacts than intensive aquaculture (Basurco & Lovatelli 2004; Canyurt 1996). It is necessary to support the development of sustainable aquaculture. For this purpose European Commission (2002) designed a strategy document for the sustainable development of aquaculture in Europe. As a candidate country to the European Community, Turkey takes all the measures to respect and to adopt the rules designed by the European Commission. Fisheries and Aquaculture file is one of the 31 files have been discussed with Commission in 2005. The importance of aquaculture has been recognized by the Ministry of Agriculture and Rural Affairs and by the private sector in collaboration with the Universities. The development of aquaculture is very important in Turkey because it provides jobs.

The aquaculture sector in Turkey is facing some constraints, such as:

- The complexity of licensing procedures,

- Site selection problems,
- The complexity of project preparation and application,
- Problems with some other sectors, like tourism, protected areas and navigations,
- High prices of inputs and difficulties in supplying,
- Disease risk with imported eggs and fry,
- Marketing and quality control problems,
- Lack of organization of the sector can be cited as major constraints of aquaculture in Turkey to be solved.

For this purpose a research project has been conducted by M A R A and TUBITAK (The Scientific and Technological Research Council of Turkey) to evaluate the impacts of fish farms on the aquatic environment, This research program has been leaded in Izmir, Mugla, Aydın and Ordu.

In conclusion of this study we can say that the sustainable development of aquaculture is very important economically and environmentally. We can consider that the impact of fish farms depends on the biological activities of the species produced and management techniques used. The oxygen consumption, the metabolism of nitrogen and phosphorous and chemicals used for different diseases are some factors determining this impact on the environment. The constraints faced in sustainable aquaculture in Turkey have to be examined and discussed.

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